Flood forecasting with machine Learning, data Assimilation and Semi-pHysical modeling

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ANR FLASH (ANR-09-SYSC-004)

Flood forecasting with machine Learning, data Assimilation and Semi-pHysical modeling

Flood forecasting by machine learning : results with rain gauge data and introduction of weather RADAR measurements

Partners :

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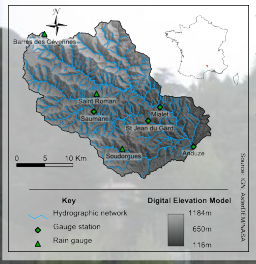
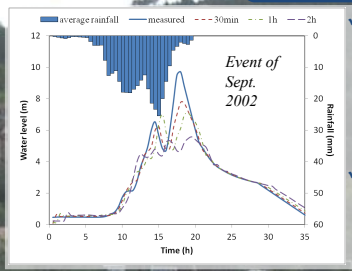
ANR FLASH project (2009-2013) intends to capitalize on the advantages of machine learning methods in order to provide tools for real-time flash floods forecasting. In a first step, water level forecasts were provided based on rain estimation of rainfalls, leading to the design of a demonstrating software. In a second step, weather RADAR measurements will be taken in advantage, as for rainfall estimation than for directly inputs reflectivity to the model. Comparison between the 3-type of inputs (rain gauge rainfall, RADAR rainfall, COMEPHORE reanalysis) will be assessed.

Study area

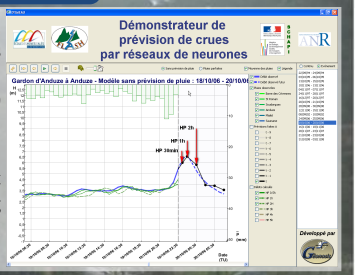


- Area : 545 km²
- Response time : 2h < t < 5h
- Reference flood: September 2002 Discharge~3000m³/s (10m) at *Anduze*) Rainfall : 690mm in 2 days.

Results with rain gauge data

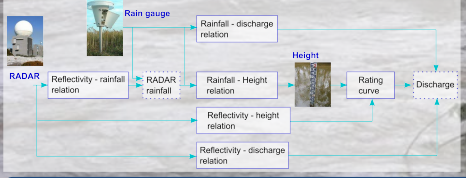


- Without rainfalls forecasts, the neural model provides interesting results for horizons of prediction (*Hp*) 30min, 1h and 2h. (left)
- Based on the rainfall-height relation, a demonstrating software was implemented. (right)



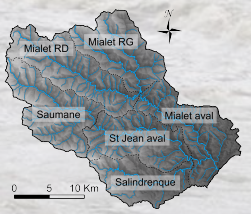
Systemic modeling

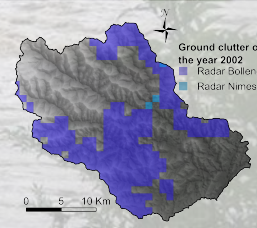
- As black-box models, artificial neural networks bring forecasting without assumptions about future rainfalls. All relations of the hydrometeorological warning chain can be implemented.



Use of rainfall by RADAR

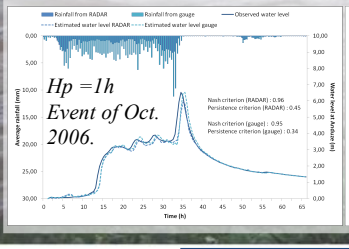
- 6 zones, hydrologically consistent, were defined in order to apply RADAR rainfalls to the Neural model (allowing thus the comparison with the model fed by rain gauge rainfalls).
- The database contains 11 events, between 2000 and 2006 (extent of the COMEPHORE reanalysis).

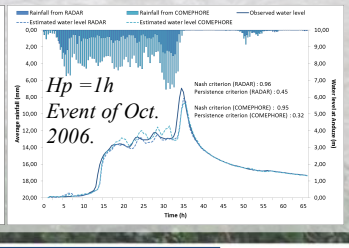




- Suppression of ground clutters and resampling data from 5 min to 30 min (*Nîmes* RADAR).
- Currently, the partial beam blocking map is not use. It will be investigated in a second step.

First results with RADAR rainfall





- First results show that the model takes into account spatialized rainfall and predictions with rainfall from RADAR are interesting.
- Now, it is necessary to improve the rainfall spatial information by testing another cutting of radar images (different of sub-watershed). A larger number of zones could better take into account the spatial information.
- Use of the partial beam blocking map (from metadata of COMEPHORE) to improve the quality of weather RADAR measurements.

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The neural model provides interesting results on the *Gardon of Anduze* catchment , with rainfall from rain gauge and RADAR. As part of the project, this methodology will be extended to others Mediterranean watersheds, like the *Ardèche* catchment.

Next stages are a greater spatialization of the rainfall from RADAR and working directly with reflectivities as inputs of the model.

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